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FEDERAL LAW ENFORCEMENT
WIRELESS USERS GROUP
WASHINGTON, D.C.

July 17, 2000

Magalie Roman Salas
Secretary
Federal Communications Commission
TW-A325
445 Twelfth Street, SW
Washington, DC 20554

Re: Reply Comments in response to comments filed by other parties regarding the Commission's Notice of Inquiry, *In the Matter of Inquiry Regarding Software Defined Radios*, in ET Docket No. 00-47

Dear Ms. Salas:

On behalf of the Federal Law Enforcement Wireless Users Group (FLEWUG) and pursuant to Section 1.419 of the Commission's rules, 47 C.F.R. § 1.419 (1999), enclosed herewith for filing are an original and four (4) copies of the FLEWUG's Reply Comments in the above-referenced proceeding.

Kindly date-stamp the additional, marked copy of this cover letter and return it in the envelope provided.

Should you require any additional information, please contact the undersigned.

Respectfully submitted,

James J. Flyzik
Deputy Assistant Secretary
(Information Systems), and
Chief Information Officer,
Department of the Treasury, and
Vice Chair, Government Information Technology
Services Board

Before the
Federal Communications Commission
Washington, DC 20554

In the Matter of	)	
Inquiry Regarding Software Defined Radios	)	ET Docket No. 00–47

FEDERAL LAW ENFORCEMENT WIRELESS USERS GROUP'S REPLY COMMENTS IN RESPONSE TO COMMENTS FILED TO NOTICE OF INQUIRY

1. The Federal Law Enforcement Wireless Users Group (FLEWUG)[1] respectfully submits the following Reply Comments in response to comments filed by other parties regarding the Commission's Notice of Inquiry, *In the Matter of Inquiry Regarding Software Defined Radios.* In the Software Defined Radio (SDR) Notice of Inquiry (NOI), the Commission requests information from the wireless community on SDR technology to help guide possible policy and regulation in such matters.

I. BACKGROUND

2. Given its mission, the FLEWUG has a clear interest in the proceedings related to the

[1] The FLEWUG is comprised of law enforcement and public safety officials from the Department of the Treasury, Department of Justice, Department of the Interior, Department of Agriculture, Department of Defense, Department of Health and Human Services, United States Postal Service, United States Postal Inspection Service, National Telecommunications and Information Administration, Federal Emergency Management Agency, Internal Revenue Service, Federal Bureau of Investigation, United States Secret Service, United States Coast Guard, United States Capitol Police, Drug Enforcement Administration, United States Park Police, Immigration and Naturalization Service, United States Customs Service, Bureau of Alcohol, Tobacco, and Firearms, United States Mint, National Communications System, Defense Information Systems Agency, National Security Agency, Federal Law Enforcement Training Center, Bureau of Engraving and Printing, United States Marshals Service, National Institute of Standards and Technology, United States Forest Service, United States Fish and Wildlife Service, Federal Bureau of Prisons, Bureau of Land Management and National Park Service.

development of any new technology that could potentially enhance or otherwise affect the operation of public safety wireless communications. This interest includes the areas of the state of SDR technology, interoperability, improving spectrum efficiency and spectrum sharing, and equipment approval, as highlighted by the Commission in the NOI. Additionally, the FLEWUG wishes to renew its request that the Commission consider the development of receiver protection standards for public safety equipment as part of its rulemaking process.

II. STATE OF SOFTWARE DEFINED RADIO TECHNOLOGY

3. The FLEWUG concurs with the National Telecommunications and Information Administration (NTIA) that the physical limitations of the SDR, coupled with the current state of technology, are limiting factors.[2] Although SDR development has potential benefits, the FLEWUG, like the NTIA, is concerned that the expectations regarding SDRs not outpace technical development and that operational and regulatory considerations continue to be based on functional reality.

III. INTEROPERABILITY

4. The FLEWUG is cautiously optimistic about the prediction of Motorola, Inc. (Motorola) that common equipment would eventually create a greater number of multi-regional partnerships that increase interoperability[3] and is also encouraged by AirNet's suggestion that SDRs could facilitate roaming without today's need for multiple or multi-mode radios.[4] The FLEWUG is also hopeful that using the digital signal processor (DSP) functionality of SDRs to modify operating frequency, power, and modulation will permit different public safety agencies to interface to a single base station to provide interoperability.[5] At the same time, however, The FLEWUG shares Nokia's concerns that, given the substantial technological and operational differences between public safety and commercial wireless systems and the relatively stable growth of public safety users compared to rapid growth of commercial users, SDRs may not offer a solution to public safety interoperability, at least in the near term.[6]

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[2] NTIA Comments at pp. 6–7.
[3] Motorola Comments at p. 22.
[4] AirNet Comments at p. 8.
[5] *Id.* at p. 9.
[6] Nokia Comments at p. 5-6.

5. The FLEWUG, which adopted, by vote, the ANSI TIA/EIA 102 (Project 25 Phase I) as the digital interoperability standard for radio communications,[7] has long supported standards development efforts to increase uniformity among public safety agencies. On that basis, the FLEWUG concurs with the Association of Public-Safety Communications Officials-International, Inc. (APCO) that equipment standards are essential for achieving interoperability.[8] In that regard, the FLEWUG is optimistic about SDR Forum's belief that SDR technology would allow for a proliferation of air interface standards for defense and public safety.[9] This would allow standardization to achieve the necessary compatibility for spectrum sharing and co-equal access[10], while allowing a degree of individual flexibility among local, state, and federal public safety entities.

IV. IMPROVING SPECTRUM EFFICIENCY AND SPECTRUM SHARING

6. The FLEWUG shares APCO's concern that although SDR technology may be able to maximize spectral efficiency through discovering unused channels, this process could potentially disrupt public safety operations.[11] Public safety operations may often dictate that certain portions of spectrum remain idle for a period, but when emergency response situations arise, this spectrum must be available immediately. The FLEWUG also concurs with Motorola that SDR technology would not be enough to allocate spectrum in real time; new spectrum allocation algorithms in the network would be required.[12] The FLEWUG further agrees with Motorola's concern regarding "ad hoc" spectrum allocation, and shares Motorola's belief that allowing services to be placed adjacent to one another without proper consideration of interference scenarios will not serve the public interest.[13] The FLEWUG supports Motorola's conclusion that operating over increasingly wider frequency ranges will require careful assessment of the interference scenarios between various portions of the spectrum and the services operating in that

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[7] *See* FLEWUG Petition for Reconsideration and Clarification, WT Docket No. 96–86 (December 2, 1998) at paragraph 33.
[8] APCO Comments at p. 3.
[9] SDR Forum Comments at p. 18.
[10] *See* Federal Law Enforcement Wireless Users' Group (FLEWUG) Ex Parte Comments, WT Docket No. 96–86, September 16, 1999.
[11] APCO Comments at p. 3.
[12] Motorola Comments at p. 28.
[13] Id. at p. 27.

spectrum.[14]

7. For these reasons, the FLEWUG is concerned about the Shared Spectrum Company's claim that an SDR may identify compatible and useful channels and switch to them, independent of the interference it may cause for others.[15] Noting the Shared Spectrum Company's reference to the NTIA San Diego Case Study, which identified several areas of unused spectrum,[16] the FLEWUG asserts that, although spectrum usage can and should be increased by new technology, it cannot occur at the expense of interference with public safety systems.

8. Rather, the FLEWUG is encouraged by the NTIA's prediction that SDR technology could increase channel access efficiency through real-time channel selection but shares the NTIA's concerns that actual benefits from such spectrum efficiency improvement have yet to be quantified.[17] The FLEWUG therefore concurs, as it has in numerous previous instances,[18] with the NTIA's long-standing recommendation that the Commission promote the development of industry standards for receivers to reduce the potential for interference from adjacent transmitters.[19] The FLEWUG also concurs with the NTIA's recommendation that the Commission permit first-generation SDRs to seek dynamic assignment in the bands allocated for their service, noting that the NTIA is examining use of dynamic channel assignment for Federal Government SDRs.[20]

9. The FLEWUG concurs with the American Petroleum Institute (API) that although the SDR technology may provide flexibility because it offers additional open frequencies, it may also cause interference, and that it is important to maintain clear channels for emergency response.[21] The FLEWUG emphasizes that interference with mission-critical public safety communications even to a limited extent, or even for a short duration, is unacceptable.

10. For this reason, the FLEWUG disagrees with the Shared Spectrum Company's

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[14] *Id.*
[15] Shared Spectrum Company Comments at p. 9.
[16] *Id.* at p. 10.
[17] NTIA comments at p. 15.
[18] *See*, e.g., FLEWUG Ex Parte Comments, WT Docket Nos. 99–168 and 96–86, December 10, 1999, at Para. 7–8.
[19] NTIA comments at pp. 15–17.
[20] *Id.* at p. 18.
[21] API Comments at p. 6.

conclusion that capacity gains are achievable through spectrum sharing or by putting together several small allocations of bandwidth, excluding only global positioning system (GPS) and safety-of-life Federal Aviation Administration (FAA) bands.[22] The protection from interference on all public safety bands must be maintained through every step of the allocation and licensing process. The FLEWUG therefore opposes Shared Spectrum Company's request that the Commission remove all possible obstacles to the full SDR implementation in the TV bands in Part 2 of the Rules.[23]

11. The FLEWUG likewise opposes AirNet's advocacy of relaxing Commission rules and awarding preferential licensing for SDR-based operators.[24] The FLEWUG joins BellSouth in cautioning that the anticipated benefits contemplated by the Commission and other parties are not attainable in the near term[25] and urges the Commission not to adopt licensing and regulatory schemes that could potentially cause harmful interference on public safety channels without any corresponding benefit.

12. The NTIA predicted that SDR technology could potentially increase channel access efficiency through real-time channel selection. However, the NTIA cautioned that actual benefits from such spectrum efficiency improvement have yet to be quantified.[26] The NTIA further recommended that the Commission promote the development of industry standards for receivers to reduce the potential for interference from adjacent transmitters.[27] The FLEWUG concurs with the NTIA on both points. The FLEWUG has long supported the NTIA in advocating the need to address receiver protection standards for public safety radio equipment as part of the rulemaking process in numerous previous filings on other dockets, as well as in the NTIA's advisory role in proceedings including the Public Safety National Coordination Committee (NCC). The FLEWUG again stresses that, regardless of the technological developments undertaken, the Commission must continue to monitor and regulate each phase of development to ensure that any initiatives related to efficiency and spectrum sharing are not

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[22] Shared Spectrum Company Comments at pp. 18–19.
[23] *Id.*
[24] AirNet Comments at p. 11.
[25] BellSouth Comments, App. B, p. 17.
[26] NTIA Comments at p. 15.
[27] *Id.* at pp. 16–17.

pursued at the expense of creating interference with public safety's mission-critical communications functions even for a short time.

V. EQUIPMENT APPROVAL PROCESS

13. The FLEWUG opposes the Shared Spectrum Company's request that the Commission grant an experimental license to demonstrate its system and waive any current regulations that limit the waveforms and protocols this technology can use.[28] As noted above, the FLEWUG is mindful of the potential long-term benefits from operational testing, and is not opposed to the issuance of experimental licenses. However, the FLEWUG urges the Commission to ensure that this experimental technology is not deployed in a manner that would in any way interfere with existing public safety functions and thereby with the protection of life and property. In choosing to err on the side of conservatism, for example, the FLEWUG agrees with the NTIA's opinion that SDR technology has not evolved to the point where radio frequency (RF) parameters can be predicted from examining only the software or hardware.[29] The FLEWUG also concurs with the NTIA's belief that first generation SDRs should be expected to comply with the individual operating and technical requirements of each service band/combination used.[30] More generally, FLEWUG also agrees with API that interference from current-generation SDR technology could threaten the reliability of public safety services.[31]

14. Regarding security issues, which are of paramount concern to much of the Federal user community, the FLEWUG notes the concerns of both APCO and BellSouth that SDR technology is subject to "hacking" and shares APCO's view that this is an unacceptable risk within the public safety community.[32] In addressing accountability, the FLEWUG concurs with Motorola that security is the responsibility of the manufacturer and products should be tamper-proof, that cryptography should be incorporated to prevent tampering and component failure, and that downloads need to be cryptographically verified before installation and execution in the SDR radio.[33] The FLEWUG also feels that binding or otherwise restricting the downloaded software

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[28] Shared Spectrum Company Comments at p. 18.
[29] NTIA comments at p. 18.
[30] *Id.* at p. 27.
[31] API Comments at p.7.
[32] APCO Comments at p. 2; BellSouth Comments at App. B, pp. 22–23.
[33] Motorola Comments at pp. 35–37.

component to prevent any unauthorized software from interacting with the hardware, as suggested by Motorola, might also protect the security of public safety systems.[34]

15. Conversely, the FLEWUG is unable to concur with AirNet's conclusion that a passive hardware bandpass filter on the RF front-end would ensure that the SDR radio would operate only in its intended band.[35] Although the FLEWUG has not evaluated this hypothesis through specific testing, given the technological complexity involved and the significant potential for both unintentional interference and intentional manipulation, the FLEWUG cannot currently accept that this basic hardware modification would ensure the protection of public safety spectrum. Similarly, the FLEWUG cannot endorse the SDR Forum's assertion that SDR technology raises no new privacy issues regarding public network operations.[36]

16. Again erring on the side of caution, the FLEWUG agrees with the NTIA that the ability to reconfigure an SDR makes it potentially vulnerable to attack, noting that the process of reconfiguration could include the following security features: 1.) authentication, 2.) acceptance, and 3.) activation. The FLEWUG urges the Commission to consider this in formulating interim, and eventually final, rules for permitting the use of SDR technology. This recommendation is in accordance with the Industrial Telecommunications Association Inc. (ITA) proposal that the Commission should establish strict standards to govern SDR to prevent harmful interference and impact on certain bands of spectrum,[37] and the suggestion of API that the Commission develop safeguards to protect current users from interference caused by SDR technologies, especially in public safety communications.[38]

VI. OTHER

17. Independent of the specific issues raised in the NOI, and noting that the NOI focuses primarily on transmitters, the NTIA reiterated that there were potential adjacent band interference issues related to SDR receivers being used in multiple frequency band operation.[39] In its comments, the NTIA once again renewed its request that the Commission examine the issue of

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[34] *Id.*
[35] AirNet comments at p. 14.
[36] SDR Forum comments at p. 38.
[37] ITA Comments at p. 4.
[38] API Comments at p. 3.
[39] NTIA Comments at pp. 29–31.

receiver protection as part of its rulemaking process.[40] The FLEWUG joins the NTIA in emphasizing that transmitter standards alone will not be sufficient to guarantee that public safety receivers will remain free of harmful interference at all times, and that standards for public safety receivers themselves should be mandated by the Commission.

VII. CONCLUSION

18. In summary, whether dealing with the development of SDR technology, facilitating interoperability, improving spectrum efficiency and spectrum sharing, or addressing the issue of equipment approval and certification, the FLEWUG joins those Commenters that advise the FCC to balance the need for innovation against the ongoing operational needs of the public safety community. In particular, the FLEWUG urges the Commission to take measures to ensure the protection of public safety spectrum from harmful interference, specifically by addressing the NTIA suggestion that the Commission develop standards for public safety receivers. The FLEWUG requests that the Commission resolve any doubts about approving interim or final equipment standards or operating procedures for SDRs, or any other emerging radio technology, to ensure that mission-critical public safety wireless communications are not subject to interference or interruption to any degree or for any length of time.

Respectfully submitted,

James J. Flyzik
Deputy Assistant Secretary
(Information Systems), and
Chief Information Officer,
Department of the Treasury, and
Vice Chair, Government Information Technology
Services Board

[40] *Id.*

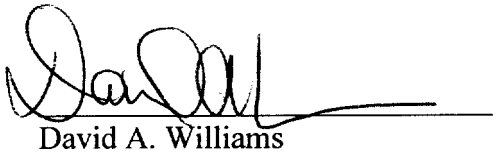
Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
Inquiry Regarding Software Defined Radios	)	ET Docket No. 00–47

CERTIFICATE OF SERVICE

I, David A. Williams, Senior Associate, Booz·Allen & Hamilton, Inc., 8283 Greensboro Drive, McLean, Virginia, 22102–3838, hereby certify that on this date I caused to be served, by first–class mail, postage prepaid (or by hand where noted) copies of the Federal Law Enforcement Wireless Users Group's Reply Comments in response to comments filed by other parties regarding the Commission's Notice of Proposed Rulemaking, *In the Matter of Inquiry Regarding Software Defined Radios*, the original of which is filed herewith and upon the parties identified on the attached service list.

DATED at Fair Oaks, Virginia this 17th day of July 2000.



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